

Sustainable Development in Chennai's Construction Industry-An Agenda for the Future

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Abstract— Sustainable construction is the process for the building and infrastructure to move ahead towards gaining sustainable improvement, taking into consideration on the environmental, socioeconomic and cultural issues. This study presents the construction scenario of Chennai and the development in sustainable construction taking place in the city. It is known that changes in the behaviour of individuals, institutions and organizations are a prerequisite for sustainable development. Sustainable development has been considered as an important issue in the construction industry. The purpose of this study is to investigate and suggest the factors motivating sustainability development in the construction firms. The development that meet the needs of the present without compromising the ability of the future generation to meet their own needs. The factors affecting the implementation of sustainable and the future solution for successful implementation of are discussed. In the conclusion the status of sustainable construction in Chennai is still in its early period. This framework enables all construction companies in Chennai to assess the project sustainability performance in a consistent and acceptable way, thus showing progress through cooperation among all stake holders and real estate development & promoters to attain satisfactory project sustainability performance.

Keywords — Sustainable Development, criticality index, sustainability performance, agenda for the future.

I. INTRODUCTION

Sustainable construction is a natural common sense, not just an economic solution, Chennai's economic solution and development can be stated by which before people used air conditioners, houses were built in a certain way to provide shade.

The inspiration for sustainable construction in extracted from history and the past green building is one of the most important pillars of green architecture, which enables a leap in sustainable development. The avenue of sustainability is a balance between rights, the

environment and economy. Construction industry owners are in eager and getting enthusiastic to get themselves engage in sustainable development practices that will support the government interact to provide adequate & affordable housing solution for all Chennai people. The ultimate aim is to build safe communities capable of withstanding factors such as the effects of climate change. The sustainable housing development as the provision that is in harmony with the environment "cannot build on every given space that is available". Rural development is critical for an integrated approach to sustainability and for reducing poverty. Ensuring wides and inclusive access to public services can reduce rural/urban inequalities, disaster risk and food insecurity, as well as strengthen networks between cities and villages. Building sustainable cities requires investment in renewable energy sources, efficiency in the use of water and electricity, design and implementation of compact cities, retrofitting of buildings and increase of green areas, fact reliable and affordable public transportation and improved waste and recycling system. Cities in poor countries used to support green technology, development has come with a cost on environment and we need to move on with a sustainable life style for the future and next generation.

1.1 PRESENT SCENARIO

The construction sector transparency initiative cost estimates that upwards of 4 million is annually cost through mismanagement, inefficiency and corruption in public infrastructures on average 10 - 30 % of project values. The reason is corruption, a key element in economic underperformance and major obstacle to poverty alleviation and development. The evil phenomenon is found in all countries big and small rich and poor but it is in the developing world that its effects are most destructive. The construction industry now is in the epicentre of world's biggest fight against corruption.

1.2 NEED FOR THE STUDY

The challenge is about ensuring sustainable development while taking advantage of economic growth that results from rapid urbanisation in the country. For long urbanization has been looked at from the limited perspective of providing basic services. But our contemporary response shall be wide ranging aiming at serving larger macro-economic transformation goals together with meeting local priorities. We need to go for a big push to harness fully the potential of urbanization. High carbon structures – around 1500 coal plants are estimated to already be in construction worldwide, which would lead towards disastrous environment changes. It says that green energy infrastructure will reduce air pollution and provide greater access to energy for people in developing countries not connected to coal fired power grids. The construction sector contributes to about 22% of india's total annual co2 emissions. **HUMAN FACTORS** - Negative impact on the construction – we're building up and not out, we're using less land and heating denser neighbourhood. Another issue rising is the shortage of land serviced with sewers, water and roads, and ready to build up on. Lack of serviced land restricts the creation of new housing, especially ground related homes, which is dramatically below historic norms. Escalating land pricing are making it more difficult for first time buyers to purchase homes. The act of rising government fees, a large part of which are development charges imposed by local municipalities paid by new home owners, these fees are a means to help offset the capital costs of growth related municipal services such as roads and sewers, parks and recreation and transit.

1.3 AIM & PERSECTIVE

The study aims to look how sustainable construction planning practices can be applied to cities in theory and practice to increase efficiency of land use in relation to transportation systems. The study of this paper is mainly based on literature review of sustainable construction projects and a solution for pushing the industry forward.

1.4 MATERIAL

The study is primarily based on literature studies and scientific reports on sustainable construction. The main sources used for the practical part of the paper are from official website from the city of Chennai.

II. LITERATURE REVIEW

(i) THE IMPACT OF GOVERNMENT'S POILICY ON CONTRACTORS & DEVELOPERS AND PROMOTERS

It is clear that the tamil nadu government is in a different position for framing to have taken the step of instructing authorities to freeze new projects until the top priorities and the sources of financing have been established. The

government acutely focusses its efforts on supporting channai contractors. The contractors made a clear confession that they trust the government so it will set clear goals and adopt the right strategies to effectively cushion the impact of this drastic step in Tamilnadu builders association. The members of the association made a clear decisive on that the derivative to the tender board, that no new tenders be awarded by government authorities until the 20/7/18 budget review and the reprioritization of capital projects have been finalised that feasibility studies for capital project to be put on hold. The government is facing budgetary constraints for a number of reasons, which are further aggravated by unforeseeable changes of macro-economic conditions and climatic conditions that increase burden on government funds. The government has also noted that the contractors have ample capacity to develop the much needed infrastructure in the country, and is adamant that local contractor under current circumstances.

(ii) CASHFLOW MANAGEMENT

For effective cash flow management it is critical that government commits itself into a realistic time frame for paying all outstanding debt, as well as payment of future invoices of current projects. This will provide a degree of confidence which is very important for the stabilization of our industry.

(iii) PUSHING THE CONSTRUCTION INDUSTRY FORWARD

By not withstanding any resistance from the construction industry new anti-corruption rules should be created and made stricter in response to the social pressure that arises. Two principles should coincide the action of the construction industry (i) greater transparency in the construction industry's relationship with government and the public sector, (ii) better governance of public investment, or those financed by public funds given the needs to improve their quality and the impact on the population well-being.

III. GUIDING FACTORS FOR SUSTAINABLE BUILT ENVIRONMENT

(i) THE LONG TIME GOAL

Each company must take all reasonable steps to minimise any detrimental impacts its operations may have on the environment and to promote good environment practice.

(ii) PLANNING AND EXECUTION

Ambition without direction is pointless. The company need to embed the environment within our building designs that should be company's direction. The starting point in that every single environment should be met,

unless we justify that a particular requirement is non-viable.

(iii) BUDGET EVALUATION AND ITS BENEFITS –

The company giving a project a green light should come down to the “evaluation of benefits”. But these are often some hidden or unintended – consequences to consider. Every responsible that the company takes needs to stand up on its own access a cost benefit point of view.

(iv) BUSINESS FROM RISK TO PLIABILITY In terms of carbon emission c company should not only improve the regularity landscape, but also the climate proofing should be done. The company need to do a lot more to measure the costs and risks associated with environmental impacts such as flooding and heatwaves. Not only will the ongoing rise in “hottest months” add to ventilation costs and also the flooding can impact sales as well as damaging buildings. The company can also price how much this cost in terms of loss of trade and repair, and then use that value to decide how much they need to invest in reduction.

(v) INTERNAL ALLIANCE

It is claimed that projects are rarely constructed in silo, but rather the people involved would speed across different management areas. This adds the complexity of different teams arriving for different objectives to deliver against different company. It's important to embed sustainability and it removes the chances of variation and uncertainty as each person involved on a project understands what their responsibilities are and how they can influence it.

(vi) EXTERNAL ALLIANCE

Despite the current uncertainty shrouding built environment policies, the owner should constantly be working with government department, membership's bodies and trade associations in an attempt to “steer policies”. The owners should collaborate to create a better result in driving sustainable change.

(vii) REVOLUTION IS THE DRIVER

Technology such as lighting and refrigeration in enabling retailers to “stay ahead of the curve” in regards to enhancing the efficiency. We're sitting at the juncture now where date is beginning to transform how we design build and operate.

Building maintenance and operations often an overlooked but crucial part of buildings lifecycle- can tract several data sets such as air quality, lighting, utility data, leasing data, thermal comfort, HVAC, weather, waste and recycling, severity and

occupancy. Gathering this kind of information and used effectively, smarter because decisions and if gathered and energy costs in rights gained from building data can reduce energy costs. It's more than automated data collection, and driving innovation and social sensitivity into the built environment. The companies looking to implement new technologies for data tracking to make sure they use a user-friendly approach. Firms should ensure that social and environment responsibility are core values, as they can make business more competitive.

IV. AGENDA FOR THE FURURE

Stating that cities used to be made efficient, productive, inclusive safe and sustainable, the future plan for the next two decades proposed in the national report will be ensuring economic growth and productivity, improving quality of life and importantly, addressing issues of inductivity, sustainability and climate change. Elaborating on the strategy for transforming urban India, it is believed that it will be achieved through elimination of barriers to the flow of factor of production like capital land, labour development of rural and urban areas in a synergic manner adopting a “regional planning approach” promoting inclusivity by ensuring urban services to all sustainable urban planning, empowering municipalities to improve governance and deal with exclusion issues, housing for all urban poor and ensuring social justice gender equity.

INFLUENTIAL FACTORS FOR BUILDING UP A SUSTAINABLE CITY/ENVIRONMENT

The home building in Chennai construction industry strives to build complete communities where residents can live, work and play. The goal is to create self-sustaining neighbourhood that are environmentally responsible, affordable and meet the housing needs of the 100,000 new residents who arrive in Chennai each year.

(i) CHALLENGING FACTORS

For creating a sustainable environment its becoming more and more difficult to create thriving and sustainable communities because of a series of growing challenges, multi layered government policies, complex regularity frameworks and length approval timelines, escalating land prices, constraints on land supply and growing construction and labour costs are some of the factors that stops reducing our ability to build complete and affordable communities. All the contractors know the importance of being environmentally responsible and employ components such as well-planned green spaces and innovative storm mate's management. These components add to the cost of buildings and it is

important to balance the choices we make with costs so as to not overly impact affordability.

(ii) KEEPERS OF ENVIRONMENT

It's a challenge for the engineers & promoters and developers to play their part to safeguard the environment by instituting remedial measures & safety policies against factors with potentially negative impact for the country. By utilizing alternative sustainable technologies for example construction engineers can mitigate poor pollution and waste water treatment practices and other threats in equality of our environment. These will result in ensuring that housing development are in harmony with natural environment, discourage development in areas prone to natural hazards, and where possible, relocate that already exist; and promote imitativeness supporting environmentally friendly developments, such as the establishment of systems that facilitate proper waste and sewage disposal.

(iii) METHODS TO IMPROVE SUSTAINABLE CONSTRUCTION

In the recent past years, the construction industry showed their sustainability efforts through recycling construction and demolition materials, using recycled materials in construction & creating water heat and energy efficient system.

(iv) LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED RATING SYSTEM)

The green building rating system that guides the design, construction operation and maintenance of both new and old building towards sustainability interior construction and renovation.

(v) PROVIDING AN EDUCATION CENTER

The education will remain as a backbone of development – realizing that we cannot transform one world and achieve the other SDG'S – without ensuring that every citizen develops the skill sets needed to pursue sustainable development at an individual connectivity and societal level. The study says more than 60% of the world's greenhouse gases are associated with ageing power plant, roads, buildings, sanitations and other structures.

(vi) REAL ESTATE AS A TOOL FOR DEVELOPMENT

Several stake holders in the real estate say planning is critical if the government is to capitalise on the tremendous opportunities the sector provides for helping to create sustainable economic growth. Real estate can be

a pillar of economic growth if we apply planning as an overall objective or strategy.

(vii) CHANGING THE PUBLIC PROCUREMENT SYSTEM

Sustainable public procurement should be a common as an investment process that takes into account the economic, environmental and social impacts of the public spending. Bids should be preceded by appropriate technical studies and engineering projects sums up to a satisfactory level for each type of project. With proper studies public officials would be able to prepare adequate risk amendments and make timely adaptation to projects before any major problems arise public and private owners should employ innovation and alternative solutions by using performance based specification where appropriate leading to immense efficiency in design, tendering, project management, speedy resolution of complex design and production problems, less reworking and a lower cost finished product, and improved delivery and environmentally responsible buildings or infrastructures.

(viii) THE CHALLENGE FOR TRANSPARENCY

The process for awarding contracts must be open, clean and defensible and all parties must not engage in collusion, hidden commissions and other anti-competitive behaviour.

(ix) GOOD GOVERNANCE

The commitment to better governance should be assured not only by the private sector, but also by the public sector, to ensure that first, planning investment and allocations of funds are consistent with the aim of providing high quality services to the population and a competitive infrastructure for the production sector. No construction work should take place unless the relevant parties have carried out economic, geotechnical & financial feasibility studies, based on a set of plans (from concept to execution), thus ensuring the adequate and cost effective funding sorely lacking in the current system.

(x) FAVOURABLE RESULTS OF THE AGENDA

The outcomes of the new agenda based on sustainable urban planning would include reducing water and electricity use by 50% from that normal use, enabling over 60% of urban travel by public transport, generating half of power from renewable sources, promoting walking and cycling for last mile connectivity, compact and cluster urban development, promoting natural drainage patterns, reducing waste generation of all kind, promoting greenery and public places.

V. RESEARCH METHODOLOGY

The sample of this study was determined using simple random sampling technique. This type of sample is most suitable where every element in the population has a known and equal chance of being selected as a subject. In other word, each single of element in the list has the same or equal probability of being chosen.

The quantitative research was carried out and the main respondents were the Malaysia's local construction stakeholders. Previous researchers who carried out research in the sustainable development assessment frameworks suggested that the following stakeholders are crucial in attaining construction sustainability which include the Consultants (architects, quantity surveyors and engineers), Contractors (manifesting the design into reality), and the Clients (the ones who drive the sustainability needs of the projects). The numbers of questionnaires received were 94. However, only 88 questionnaires were usable out of the total responds.

DATA ANALYSIS

The level of sustainability performance in Malaysian construction industry is presented in Tables 1.2 and 1.3 below. Each table represent each category of factors which include the financial sustainability and non financial sustainability rated on a scale of 1 to 4. The most agreed for each factor was scored on a scale of 1 to 4 with 1 having the least agreed and 4 having the most

agreed. To identify the criticality index for each factor, the factor criticality was defined as in the Table 1.1 below.

Financial Sustainability Performance

The highest mean score for financial sustainability for the whole data set as perceived by the construction stakeholders is 3.2045 where the respondents believed that most of their projects had improved the used of local resources. The minimum scores are 3.0227 where the respondents believed that most of their projects are adaptable within the minimum cost. In term of critically index, all of the items can be categorized at moderate level. Overall mean for the whole data set is 3.1105, which could be considered at moderate level.

Non - Financial Sustainability Performance

The highest mean score for non-financial sustainability performance for the whole data set as perceived by the construction stakeholders was 3.1136 where the respondents believed that most of their project had optimize the land consumption.

The minimum scores were 2.8523 where the respondents believed that most of their project had reduced the greenhouse emissions. In term of critically index, only 2 items be categorized at moderate level. Overall mean for the whole data set is 2.9756 which could be considered at mild level.

Table.1.1: Criticality Assessment Criteria

<i>Mean Factor Score Range</i>	<i>Criticality Index</i>	<i>Criticality Level</i>
< 2.0	1	Least Agreed
>2.0 – 3.0	2	Mildly Agreed
>3.0 - 3.5	3	Moderately Agreed
>3.5 - 4.0	4	Mostly Agreed

Table.1.2: Mean Analysis for Financial Sustainability Performance

<i>Mean Factor Score Range</i>	<i>Criticality Index</i>	<i>Items</i>
3.1477	3	Most of our projects are cost effective over time
3.0227	3	Most of our projects are adaptable with minimum cost
3.1519	3	Most of our projects are affordable to apply
3.2045	3	Most of our projects had improved the use of local resources.
3.0568	3	Most of our projects are energy efficient
3.0795	3	Most of our projects are material efficient

Table.1.3: Mean Analysis for Non-Financial Sustainability Performance

Mean Factor Score Range	Criticality Index	Items
2.8523	2	Most of our projects had reduce greenhouse gas emissions
2.9659	2	Most of our projects had improved the waste management process.
2.8977	2	Most of our projects had improved the use of recycle and reuse resources
3.0455	3	Most of our projects had minimize the pollution (noise, water)
3.1136	3	Most of our projects had optimize the
2.9886	2	Most of our projects protect and enhanced biodiversity

VI. CONCLUSION

General objective was met through the accomplishments of the research. More importantly, the current level of sustainability performances were identified among the Chennai construction stakeholders. The result of this study shows that the performance of financial sustainability is better than non-financial sustainability. From the financial sustainability performances aspect, this study found that all the items can be classified at moderate level. However, for the non-financial sustainability performance aspect, it can be classified at the mild level. Due to the current environment of Chennai's construction industry, a few initiatives need to be taken to improve the current practices. These Initiatives include:

- Improved process; the waste management
- Improved the use of recycle and reuse resources;
- Improved the protection enhancement of biodiversity and;
- Reduce transportation dependency.

As mentioned earlier, to increase the consideration of sustainability, the construction stakeholders must be willing to change their attitudes and culture in exploring new territory and willing to adopt new ideas and practices especially regarding the environmental issues.

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